



**HITACHI**

**GE Hitachi Nuclear Energy**

Richard E. Kingston  
Vice President, ESBWR Licensing

PO Box 780 M/C A-55  
Wilmington, NC 28402-0780  
USA

T 910 819 6192  
F 910 362 6192  
rick.kingston@ge.com

MFN 08-892

Docket No. 52-010

November 14, 2008

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, D.C. 20555-0001

**Subject: Submittal of a Portion of Response to NRC Request for Additional Information (RAI) Letter 222 - Related to ESBWR Design Certification Application - Chapter 19 - PRA and Severe Accidents - RAI Number 19.2.4-1 S03**

The purpose of this letter is to submit a response to Nuclear Regulatory Commission (NRC) Request Additional Information (RAI) 19.2.4-1 S03 as requested in Reference 1.

The response to RAI 19.2.4-1 S02 was provided in Reference 2 as requested by NRC in Reference 3. The response to RAI 19.2.4-1 S01 was provided in Reference 4 as requested by NRC in Reference 5. The original response to RAI 19.2.4-1 was provided via Reference 6 in response to NRC request (Reference 7).

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston  
Vice President, ESBWR Licensing

*Doc 8  
NRO*

## References:

1. MFN 08-649 - Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 222 Related To ESBWR Design Certification Application*, dated August 15, 2008
2. MFN 05-169 S03 - Response to Portion of NRC Request for Additional Information Letter No. 121 Related to ESBWR Design Certification Application - PRA & Severe Accidents - RAI Number 19.2.4-1 Supplement 2, dated April 3, 2008
3. MFN 05-169 S02 - *Response to Portion of NRC Request for Additional Information Letter No. 3 Related to ESBWR Design Certification Application, RAI Number 19.2.4-1 S01*, dated October 5, 2007
4. MFN 07-658 - Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 121 Related To ESBWR Design Certification Application*, dated December 5, 2007
5. Transmittal from T. Kevern (NRC) To GEH, February 6, 2007
6. MFN 05-169 - *Response to NRC Request for Additional Information Letter No. 3 Related to ESBWR Design Certification Application – Chapter 19 – PRA & Severe Accident*, dated December 29, 2005
7. MFN 05-156 – Letter from U.S. Nuclear Regulatory Commission to David H. Hinds - *Request for Additional Information Letter No. 3 for the ESBWR Design Certification Application*, dated December 8, 2005

## Enclosure:

1. MFN 08-892 – Response to Portion of NRC Request for Additional Information (RAI) Letter 222 - Related to ESBWR Design Certification Application - Chapter 19 - PRA and Severe Accidents - RAI Number 19.2.4-1 S03

cc: AE Cabbage USNRC (with enclosure)  
RE Brown GEH/Wilmington (with enclosure)  
DH Hinds GEH/Wilmington (with enclosure)  
RM Wachowiak GEH/Wilmington (with enclosure)  
eDRF 0000-0092-9707

**Enclosure 1**

**MFN 08-892**

**Response to Portion of NRC Request for Additional  
Information (RAI) Letter 222 –  
Related to ESBWR Design  
Certification Application  
Chapter 19  
PRA and Severe Accidents  
RAI Number 19.2.4-1 S03**

**For historical purposes, the original text of RAI 19.2.4-1 and any previous supplemental text and GE/GEH responses are included preceding each supplemental response. Any original attachments or DCD mark-ups are not included to prevent confusion.**

**RAI 19.2.4-1**

*Provide a discussion or commitment (combined operating license action item) regarding the accident management program under which guidance and training would be provided on the use of such features as containment venting, drywell sprays, and AC-independent fire pumps for isolation condenser make-up.*

**GE Response**

Revision 1 to the ESBWR DCD Chapter 19 will contain a list of COL Applicant commitments that include the following text:

“The COL Applicant referencing the ESBWR certified design will develop and implement severe accident management guidance, along with the required procedures and training, using the framework provided in DCD Chapter 18, Appendix A.”

ESBWR DCD Revision 1 is to be submitted in accordance with the schedule provided in GE Letter, MFN 05-139, dated November 22, 2005.

Transmittal from Tom Kevern.

**NRC RAI 19.2.4-1 S01**

*The response provided to RAI 19.1-18 discussed uncertainty and sensitivity analyses related to the EPRI BWR Applications Guidelines. This report only addressed thermalhydraulic phenomena that are important to predicting severe accident sequences. It did not address severe accident-related model parameters, nor did the response to the RAI.*

*Please document any analyses in which MAAP model parameters were varied, particularly those related to peak drywell pressure during a high-pressure scenario and to the potential for drywell liner failure in sequences where the BiMAC does not function.*

**GEH Response**

See response to RAI 19.1-18 S01.

**DCD/NEDO 33201 Impact**

No DCD changes will be made in response to this RAI.

No changes to the subject NEDO-33201 will be made in response to this RAI.

**NRC RAI 19.2.4-1 S02**

*The response to RAI 19.4.2-1 in MFN 05-169 indicated that Revision 1 to the DCD Chapter 19 would contain a list of COL Applicant commitments that would include text indicating that the COL applicant referencing the certified design will develop and implement severe accident management guidance, along with the required procedures and training, using the framework provided in DCD Chapter 18, Appendix A. In Revision 4 of the DCD, such text does not exist. Instead, Chapter 18, Revision 4, now has the following wording:*

*Technical bases for severe accident management (core damage prevention and mitigation strategies and actions to limit radionuclide releases with off-site dose limits) are documented in Item 7 of DCD Tier 1, Table 3.3-1 for HFE. Standard guidelines, procedures, and training modules are developed as described in Reference 18.1-1. The PRA and Human Reliability Assessment (HRA) confirm that the Emergency Procedure Guidelines (EPGs) and severe accident guidance effectively address:*

- o Preventing core damage,*
- o Recovering from core damage*
- o Maintaining containment integrity, and*
- o Minimizing radionuclide releases*

*The standard guidance and EPGs are used to develop and validate site-specific severe accident mitigation guidelines and procedures that satisfy Reference 18.1-2.*

*Reference 18.1-1, dated July 2007, is an ESBWR Licensing Topical Report that describes the Man-Machine Interface and Human Factors Engineering Implementation Plan. Reference 18.1-2 is an Industry document (NEI 91-04, Revision 1) on Severe Accident*

*Closure Guidelines that provides an overview on how the existing plants should implement severe accident management guidelines. Section 3.2.4.5 of Reference 18.1-1 describes what GE calls its Emergency Management Program. This section lists GEH and applicant responsibilities in developing an emergency management program that would include procedures for preventing and mitigating the effects of severe accidents. The tone of the write up suggests that GEH may be considering the accident management program to be a COL information item. However, Section 19.3.6 of Revision 4 of the DCD omits any mention of it.*

*In light of the above, please answer the original RAI again, namely, provide a discussion or commitment (combined operating license information item) regarding the severe accident management program under which guidance and training would be provided on the use of such features as containment venting, drywell sprays, and AC-independent fire pumps for isolation condenser make-up.*

### **GEH Response**

Note that this response is substantially similar to the GEH response to NRC RAI 18.9-1 S02 (MFN 08-155, dated March 26, 2008) as the subject matter of the two RAIs is closely related.

The COL applicant commitments discussed in previous answers to this RAI will not be added to the DCD. As described below, ESBWR EPG/SAGs and the EOPs and SAMGs derived from them will be developed by the ESBWR design team.

The GEH top down HFE operational analysis and procedures development process will generate ESBWR EPGs/SAGs and the EOPS and SAMGs derived from them. Additionally, the HFE training development process will generate the training required to support performance of the ESBWR EOPs and SAMGs. Details regarding the documents that govern these processes are provided below.

DCD Reference 18.1-1, dated July 2007, is an ESBWR Licensing Topical Report (LTR) that describes the Man-Machine Interface and Human Factors Engineering. This reference was intended to provide insight into the integration and implementation of all DCD chapter 18 HFE activities with additional LTRs providing the details of how each HFE processes (such as training, procedures, etc) are to be implemented. In the case of EOPs/SAMGs, two HFE process area LTRs (NEDO-33274 ESBWR HFE Procedures Development Implementation Plan and NEDO-33275 ESBWR HFE Training Development Implementation Plan) provide detail and insight into the ESBWR severe accident management program development and the programs incorporation into the ESBWR training program.

ESBWR HFE Procedures Development Implementation Plan, NEDO-33274, Rev 2, March 2007 presents the procedure development processes and methodologies to be used in the development of procedures including ESBWR SAGs and the ESBWR SAMGs derived from them. Appendix A of NEDO-33274 "Summary of Emergency Operating Procedures and Severe Accident Management Guidelines" provides high-level summary insight into the severe accident management program.

Revision 2 of NEDO-33274 provides a high level presentation of how ESBWR EPGs and SAMGs are to be generated. The NEDO commits to deriving ESBWR EPGs/SAGs from BWROG EPG/SAG Rev 2. Additionally, the NEDO commits to implementing the HFE top-down operational analysis process contained in NUREG-0711, Rev 2 to develop the ESBWR EPGs/SAGs and the EOPs and SAMGs developed from their requirements. Using the processes described in

NEDO-33274, Rev 2 and the requirements and regulations noted in it, the following EOP development actions will be performed:

- ESBWR specific Appendix C calculations will be developed from the BWROG EPG/SAG, Rev 2 Appendix C adapted using ESBWR plant specific design input, analyses, instrument set points, vendor input, and other system data.
- ESBWR specific EPG/SAGs will be developed from the BWROG EPG/SAG, Rev 2 using the ESBWR specific Appendix C calculations, ESBWR plant specific Design input, PRA input, ESBWR philosophy of operation, and HFE operational analysis.
- ESBWR specific EOP writer's guide will be developed using EPG/SAG Rev 2 guidance, industry examples, HFE design team input, and ESBWR HSI design inputs. The ESBWR EOP writer's guide will provide details of the specific methods for translating and transcribing the ESBWR specific EPG/SAGs into EOPs and SAMGs.
- ESBWR EOP and SAMG flow charts and supporting emergency procedures will be generated using the ESBWR specific writer's guide, EPG/SAGs, and Appendix C calculations discussed above.

Because they are written using, and benefit from, the top-down design process outlined in NUREG-0711, Rev 2, the ESBWR specific EPG/SAGs and the EOPS and SAMGs developed from them will not be available for submittal to the NRC prior to design certification. The ESBWR HFE operational analysis process will be completed in three phases (design, detailed, and economic). The design analysis is currently in progress and analyzes the operation of the ESBWR and its systems with everything functioning as designed. The detailed analysis phase takes place following the completion of design phase analysis and analyzes the operation of the ESBWR and its systems during alarm, abnormal, and emergency conditions. ESBWR SAGs will be developed during the detailed phase of operational analysis. ESBWR SAGs and the SAMGs derived from them will be complete and available for NRC review.

As ESBWR SAGs are integral to the development of ESBWR SAMGs they will be complete and available for NRC review no later than the completion date for DCD Tier 1 Table 3.3-1 ITAAC 7. ESBWR Training Development implementation Plan, NEDO-33275, Rev 1, February 2007 presents the training development processes and methodologies to be used in the development and delivery of training including the ESBWR SAMGs.

Using the HFE top-down analysis process presented in NEDO-33275, Rev 1, each plant function will be analyzed and broken down into tasks with associated

procedures. These tasks are also analyzed in accordance with the ESBWR systematic approach to training process to ultimately determine:

- Knowledge and ability requirements,
- Needed training,
- Training objectives,
- Training frequency,
- Training materials needed,
- Training venue,
- Needed scenarios (if simulator or mockup training is determined to be appropriate),
- Examination methodology,
- Failure criteria, and
- Any other training program attributes that need to be associated with the tasks.

In the case EOP/SAMG training, analysis will determine and establish requirements for initial and requalification training on all tasks contained in the ESBWR EOPs/SAMGs.

Though the training analysis is not yet complete, it is expected that both classroom and simulator training will be required for EOP/SAMG procedures that provide guidance for addressing such things as:

- Preventing core damage
- Recovering from core damage
- Maintaining containment integrity, and
- Minimizing radionuclide releases

### **DCD Impact**

No DCD changes will be made in response to this RAI.

No changes to the subject LTRs (NEDO-33274 ESBWR HFE Procedures Development Implementation Plan and NEDO-33275 ESBWR HFE Training Development Implementation Plan) will be made in response to this RAI.

**NRC RAI 19.2.4-1 S03**

*Question Summary: Technical basis for severe accident management*

*Full Text:*

*In response to RAI 19.2.4-1 S02 in MFN 05-169, Supplement 3, GEH described how the technical basis for severe accident management would be developed for the ESBWR plants. Specifically, GEH states that it will perform four ESBWR-specific EOP development actions: Appendix C calculations, EPG/SAGs, EOP writer's guide, and EOP and SAMG flow charts. GEH also stated that these products would not be available to the NRC prior to design certification.*

*Since the NRC would need to review the severe accident management technical basis before a COL is issued, please provide documentation of the ESBWR-specific Appendix C calculations and EPG/SAGs for NRC Staff review. Also, either provide the writer's guide and EOP SAMG flow charts, or identify the development of these products as COL action items.*

**GEH Response**

This response is based on reviews of previous responses to this RAI; resolved response to RAI 19.2-37(MFN 06-441, dated 11/20/06); NUREG-0800 Chapters 13, 18, and 19; 10CFR52 - Licenses, Certifications, And Approvals For Nuclear Power Plants; NRC Inspection Manual 2504; Construction Inspection Program - Non-ITAAC Inspections; and Regulatory Guide 1.206 C.I.13.5.2.1 - Operating and Emergency Operating Procedures; and a teleconference held October 29, 2008 among NRC, GEH and utility personnel.

As a result of an improved understanding of deliverables required to satisfy NRC review of severe accident technical basis, GEH will provide an assessment of the impact of ESBWR PRA insights on ESBWR Severe Accident Management. This assessment will take the form of modifications to Section 4.0 of the BWR Owners' Group Accident Management Guidelines Overview Document capturing the ESBWR PRA as an input to severe accident insights and evaluating the PRA insights for impact on severe accident principles. Changes to the principles and new insights will then be used to recommend changes to BWROG generic severe accident strategies. This assessment will include particular emphasis and more detailed evaluation of the GDCS and BIMAC system impacts on severe accident strategies.

The output of this assessment will provide the supplement to this RAI response no later than January 31, 2009.

**DCD Impact**

No DCD changes will be made in response to this RAI.